BigDataSDNSim User Manual

Table of Contents

1 Explanation of BigDataSDNSim

1.1 What is BigDataSDNSim?

BigDataSDNSim is a discrete-event simulation tool designed to enable the modeling and simulating of big data management systems (YARN), MapReduce programming models, and SDN-enabled networks within cloud computing environments. It is the first tool that models and simulates the three merging technologies (MapReduce-BDMS, SDN, cloud) in a single simulated environment. The simulator is capable of capturing the key functions, characteristics, and behaviors of SDN-enabled MapReduce computing environment. It is also capable of modeling the functionalities of MapReduce applications in line with mimicking diverse SDN capabilities and interactions with BDMS systems in a seamless manner.

BigDataSDNSim provides abstract layers for enforcing new policy-based solutions. For instance, a MapReduce application might be located on different data center servers and/or racks due to insufficient resource capacity in a single server/rack. Such distribution logic requires a proper modeling of abstractions and interfaces so that the users of our tool can seamlessly deploy their scheduling policies for MapReduce server-rack placement. In another example, the same MapReduce application might require special QoS requirements (e.g. traffic prioritization, policy-based routing mechanisms) and excessive data transmission on the network layer from one server to another. BigDataSDNSim is modeled to seamlessly provide easy deployments of QoS requirements on behalf for every MapReduce application in SDN-enabled cloud environments.

For further details of BigDataSDNSim, please refer to our paper entitled "BigDataSDNSim: A Simulator for Analyzing Big Data Applications in Software-Defined Cloud Data Centers".

1.2 Unique Features of BigDataSDNSim

BigDataSDNSim differs from other simulation tools in supporting a holistic simulation framework that simulates MapReduce applications, BDMS, and SDN-related networks in cloud-based environments. In particular, BigDataSDNSim is capable of modeling and simulating:

- A generic big data approach for executing different big data programming models (e.g. MapReduce, Stream) simultaneously;
- MapReduce applications within big data cluster management (BDMS), which is one of the key prominent framework for running different big data models;
- The behaviors and features of SDN dynamic networks coupled with the coordination and interaction with MapReduce applications within cloud environments;
- Dynamic routing mechanisms based on graph theory to enable any type of network topology to be seamlessly simulated;
- Modeling several policies for SDN, MapReduce, and VM within cloud data centers for multilevel optimization**.**

2 Getting Started

2.1 Lifecycle of BigDataSDNSim

The functionalities of the BigDataSDNSim is classified into four phases: building a required infrastructure, establishing requested MapReduce application(s), carrying out task processing and data transmission, and finally reporting the results of every MapReduce application. The infrastructure is built by parsing a configuration file provided in a JSON format. Once BigDataSDNSim obtains the file, it initiates the corresponding objects of hosts, switches, and network links. At the same time, it establishes the required components such as SDN controller and resource manager along with building a required network topology.

2.2 System and Software Requirements

- Operating System: Windows, Linux or Mac OS.
- CPU: 1-GHz processor or equivalent (Minimum).
- RAM: 2GB (Minimum).
- Java Platform: JDK version 11+ (recommended)
- Any IDE for Java programming language such as Eclipse or NetBeans

2.3 Download BigDataSDNSim

BigDataSDNSim can be downloaded from https://github.com/kalwasel/BigDataSDNSim

2.4 Directory Structure of BigDataSDNSim

The structure of BigDataSDNSim framework is defined as follows:

- BigDataSDNSim/
- examples/ -- Contains examples of MapReduce applications in SDN-enabled Clouds
- sources/ -- Contains the source code of BigDataSDNSim
- inputFiles/ -- Contains the required files to be submitted to BigDataSDNSim
- outputFiles/ -- Contains all the output results of BigDataSDNSim

2.5 Main Packages of BigDataSDNSim

BigDataSDNSim is mainly developed using the following package list:

- org.cloudbus.cloudsim.bigdatasdn.bdms (Pkg_1)
- org.cloudbus.cloudsim.bigdatasdn.mapreduce (Pkg_2)
- org.cloudbus.cloudsim.bigdatasdn.bdms.polocies (Pkg_3)

Pkg_1 contains classes that models the behaviors and characteristics of big data management systems and SDN. Pkg_2 contains classes that models the behaviors and characteristics of MapReduce models. Pkg_3 contains a list of policies, such as SDN routing policy. Figure 2.1 shows the packages and their classes in detail.

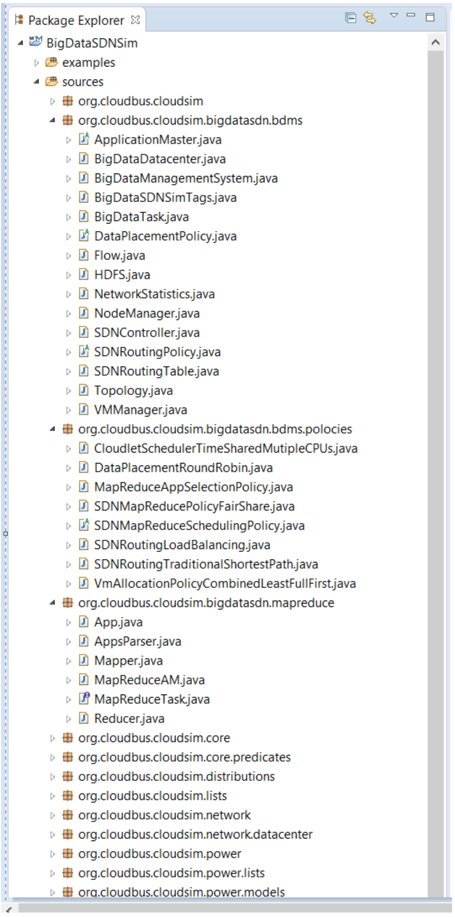


Figure 2.1

2.6 Setup BigDataSDNSim

Prior to use BigDataSDNSim, you need to import and configure the project properly. Here, we use Eclipse to illustrate how to setup the BigDataSDNSim project. The project is based on Maven. The main steps are given as follows:

Step 1:

- Install Eclipse from https://www.eclipse.org/downloads/
- Install Maven on Eclipse, follow the steps given in https://www.eclipse.org/m2e/

Step 2: Import BigDataSDNSim as a Maven project by Opening Eclipse -> selecting File -> and selecting import (see Figure 2.2)

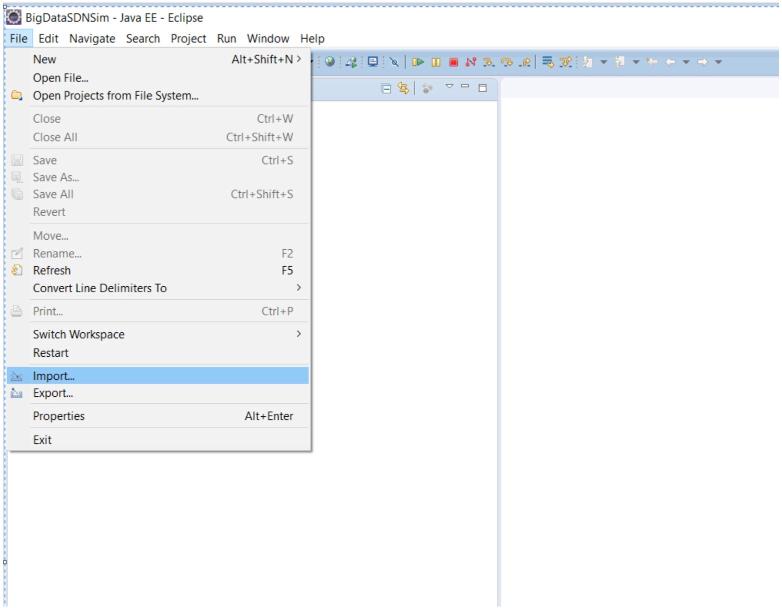


Figure 2.2

Step 3: Select Maven -> select Existing Maven Projects (see Figure 2.3)

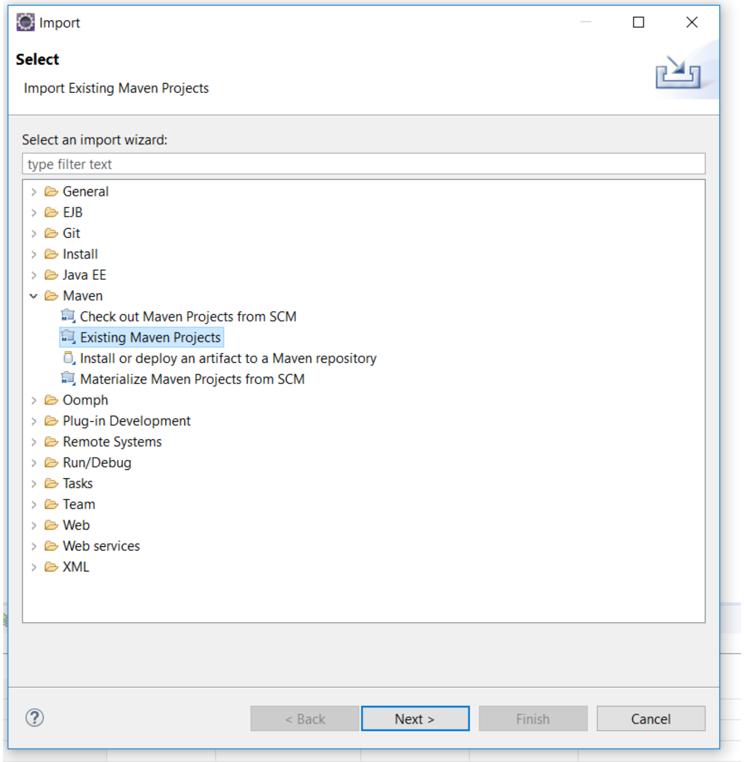


Figure 2.3

Step 4: Select the folder corresponding to BigDataSDNSim project. Next, click on Finish (see Figure 2.4)

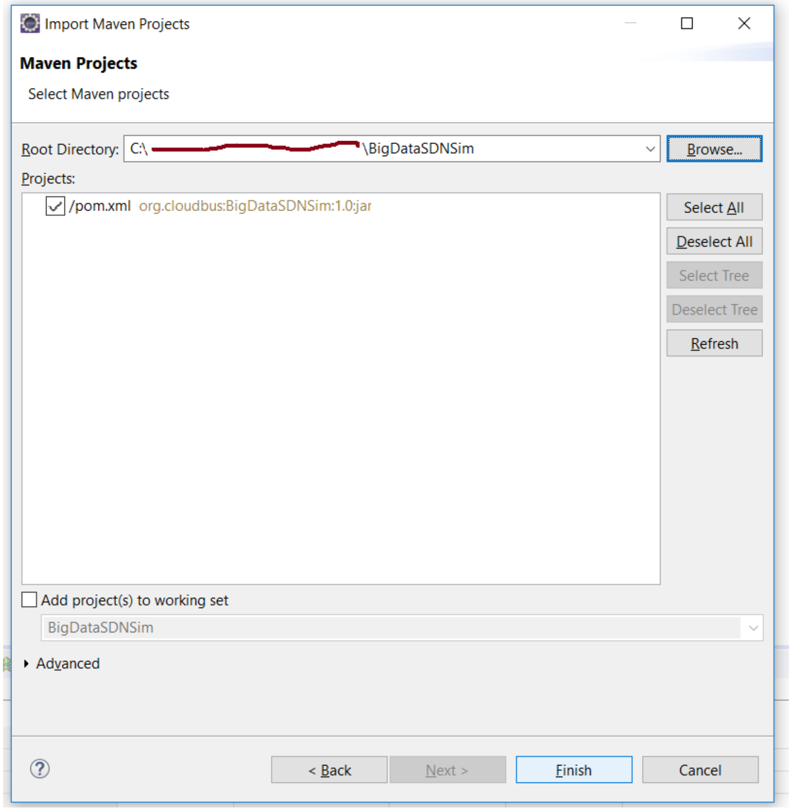


Figure 2.4

Step 5: Right click on BigDataSDNSim project and click on Update Project that found under Maven option (see Figure 2.5)

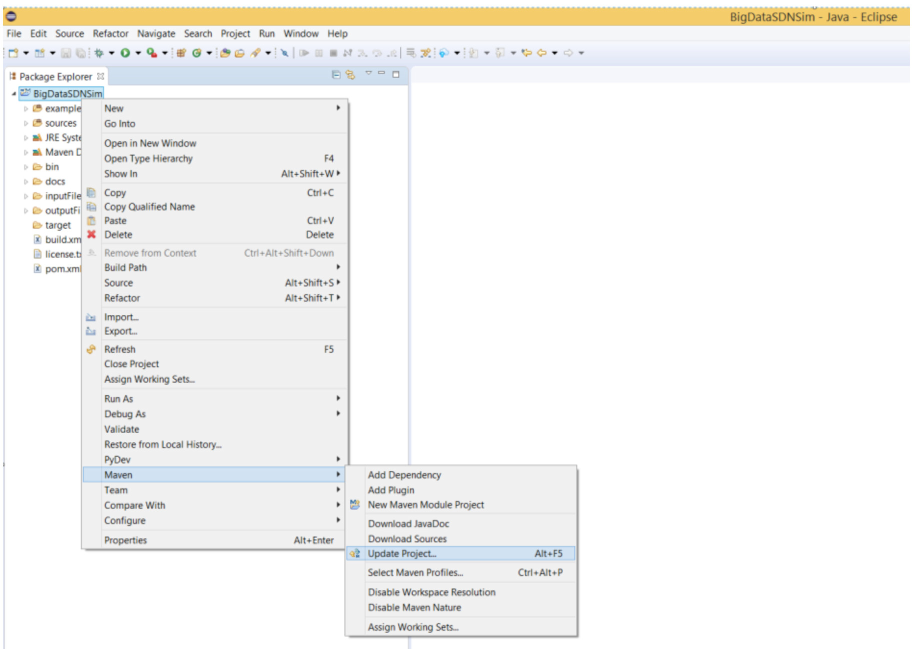


Figure 2.5

Step 6: Right click on BigDataSDNSim project and click on Maven install that found under Run As option (see Figure 2.6)

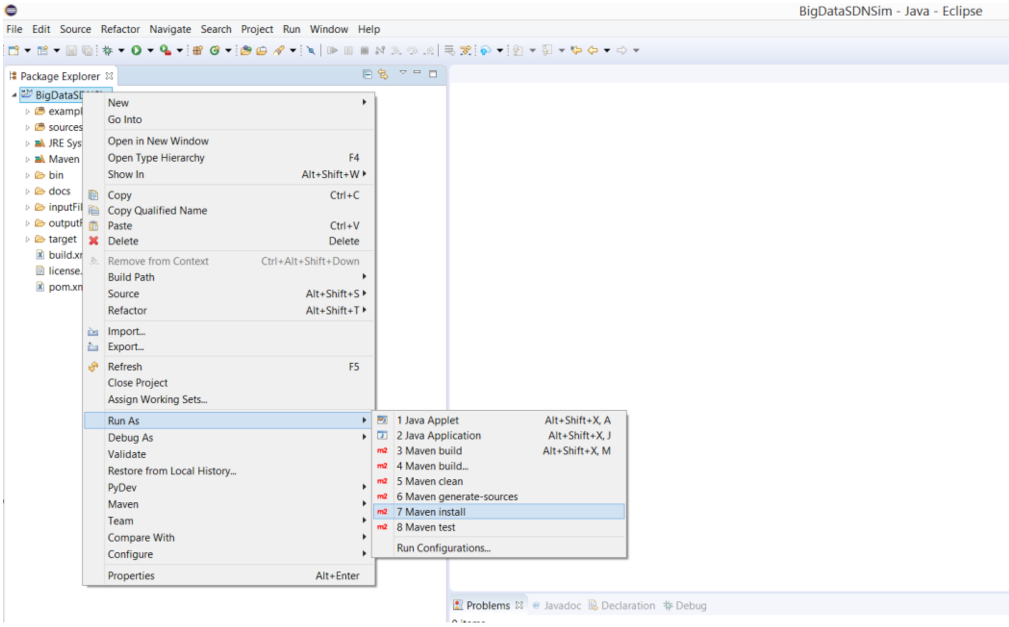


Figure 2.6

When Maven successfully builds BigDataSDNSim in your Eclipse, you will see "BUILD SUCCESS" as shown in Figure 2.7. At this point, you have successfully built and configured BigDataSDNSim.

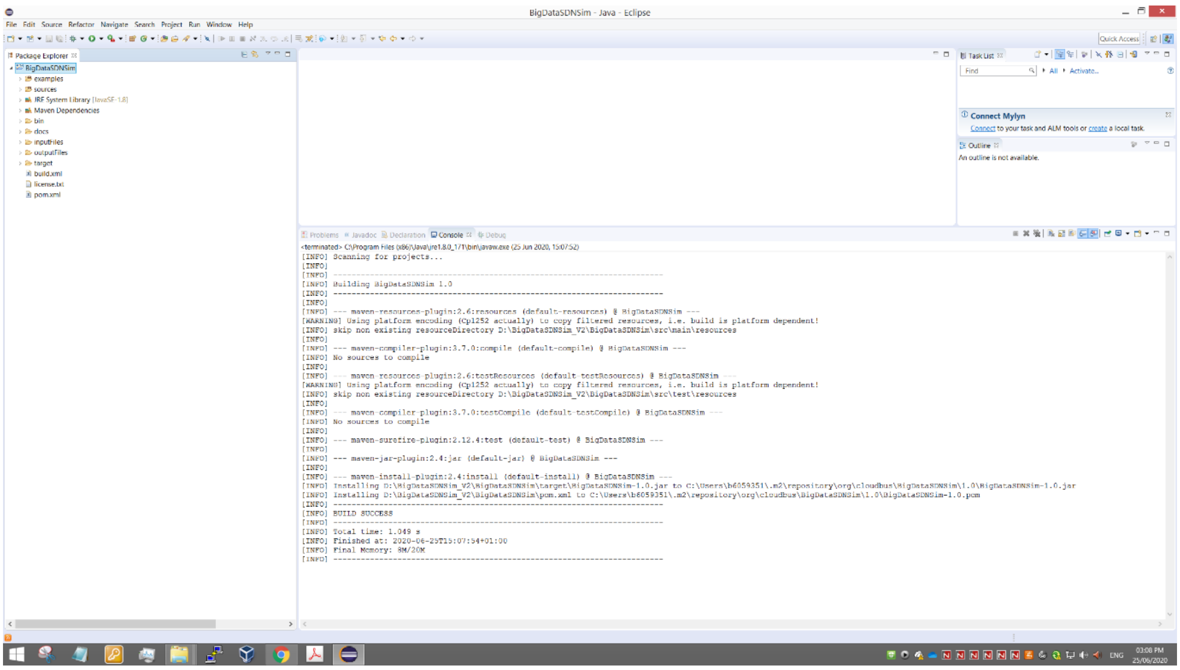


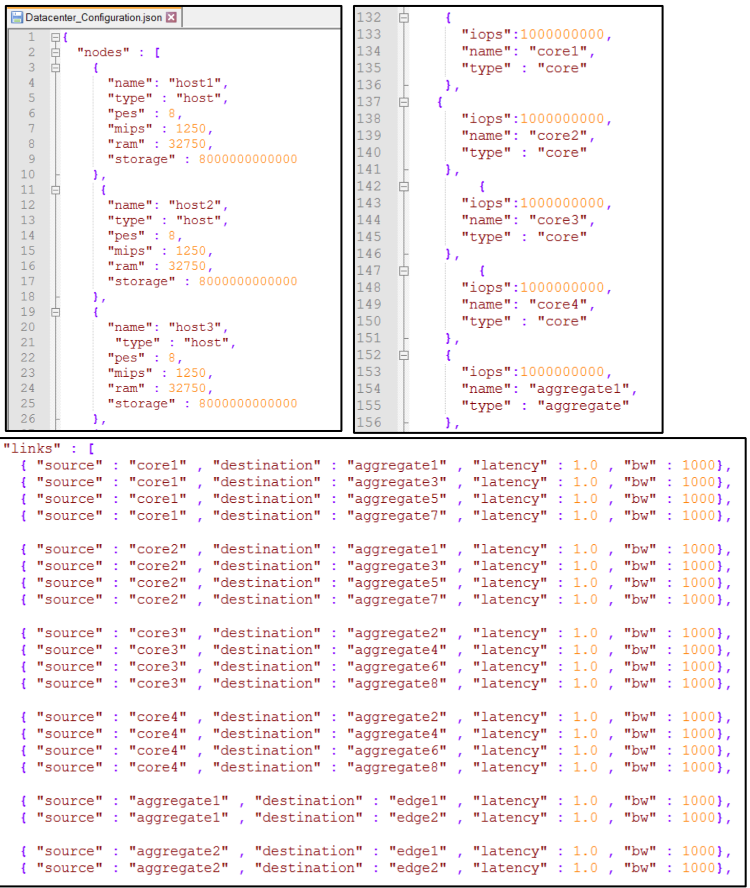
Figure 2.7

3 Simulation configuration

Before starting the actual simulation, you have to configure the infrastructure of every data center. The infrastructure of every data center can be easily configured using a configuration file named Datacenter_Configuration in the *inputFiles* folder. The parameters of the configuration file is illustrated in Table 3.1, which is defined in a JSON format. These parameters are read by the main program during initialization which configures the environment of BigDataSDNSim accordingly. A snapshot of the confirmation file is given in Figure 3.1. It shows an example of metrics used in the examples, given later.

Table 3.1 User-defined of physical configuration

Entity	Parameter	Description
nodes (hosts)	name	Node name (e.g. host1, host2)
	type	Node type (host)
	pes	Number of CPUs
	mips	Million Instructions Per Second (MIPS) rate of the host
	ram	Size of the host’s memory
	storage	Size of the host’s storage
nodes (switches)	iops	I/O rate of the switch
	name	Node name (e.g. core1, aggregate1)
	type	Node type (switch)
links	source	A node connected to one end of the undirected link
	destination	A node connected to the other end of the undirected link
	latency	The latency of the link
	bw	The bandwidth of the link



Datacenter_Configuration.json

```
{
  "nodes" : [
    {
      "name": "host1",
      "type" : "host",
      "pes" : 8,
      "mips" : 1250,
      "ram" : 32750,
      "storage" : 8000000000000
    },
     {
      "name": "host2",
      "type" : "host",
      "pes" : 8,
      "mips" : 1250,
      "ram" : 32750,
      "storage" : 8000000000000
    },
    {
      "name": "host3",
       "type" : "host",
      "pes" : 8,
      "mips" : 1250,
      "ram" : 32750,
      "storage" : 8000000000000
    },
```

```
      {
        "iops":1000000000,
        "name": "core1",
        "type" : "core"
      },
     {
        "iops":1000000000,
        "name": "core2",
        "type" : "core"
      },
          {
        "iops":1000000000,
        "name": "core3",
        "type" : "core"
      },
          {
        "iops":1000000000,
        "name": "core4",
        "type" : "core"
      },
      {
        "iops":1000000000,
        "name": "aggregate1",
        "type" : "aggregate"
      },
```

```
"links" : [
  { "source" : "core1" , "destination" : "aggregate1" , "latency" : 1.0 , "bw" : 1000},
  { "source" : "core1" , "destination" : "aggregate3" , "latency" : 1.0 , "bw" : 1000},
  { "source" : "core1" , "destination" : "aggregate5" , "latency" : 1.0 , "bw" : 1000},
  { "source" : "core1" , "destination" : "aggregate7" , "latency" : 1.0 , "bw" : 1000},

  { "source" : "core2" , "destination" : "aggregate1" , "latency" : 1.0 , "bw" : 1000},
  { "source" : "core2" , "destination" : "aggregate3" , "latency" : 1.0 , "bw" : 1000},
  { "source" : "core2" , "destination" : "aggregate5" , "latency" : 1.0 , "bw" : 1000},
  { "source" : "core2" , "destination" : "aggregate7" , "latency" : 1.0 , "bw" : 1000},

  { "source" : "core3" , "destination" : "aggregate2" , "latency" : 1.0 , "bw" : 1000},
  { "source" : "core3" , "destination" : "aggregate4" , "latency" : 1.0 , "bw" : 1000},
  { "source" : "core3" , "destination" : "aggregate6" , "latency" : 1.0 , "bw" : 1000},
  { "source" : "core3" , "destination" : "aggregate8" , "latency" : 1.0 , "bw" : 1000},

  { "source" : "core4" , "destination" : "aggregate2" , "latency" : 1.0 , "bw" : 1000},
  { "source" : "core4" , "destination" : "aggregate4" , "latency" : 1.0 , "bw" : 1000},
  { "source" : "core4" , "destination" : "aggregate6" , "latency" : 1.0 , "bw" : 1000},
  { "source" : "core4" , "destination" : "aggregate8" , "latency" : 1.0 , "bw" : 1000},

  { "source" : "aggregate1" , "destination" : "edge1" , "latency" : 1.0 , "bw" : 1000},
  { "source" : "aggregate1" , "destination" : "edge2" , "latency" : 1.0 , "bw" : 1000},

  { "source" : "aggregate2" , "destination" : "edge1" , "latency" : 1.0 , "bw" : 1000},
  { "source" : "aggregate2" , "destination" : "edge2" , "latency" : 1.0 , "bw" : 1000},
```

Figure 3.1

3.1 VM configuration

The configurations of VMs are handled by **VMManager.java** class (see Figure 3.2). We have defined different types of VMs. You can easily defined your own VM types in this class. Figure 3.2 illustrates an overview of the VMManager.java class. The required parameter for every VM is shown in Table 3.2.

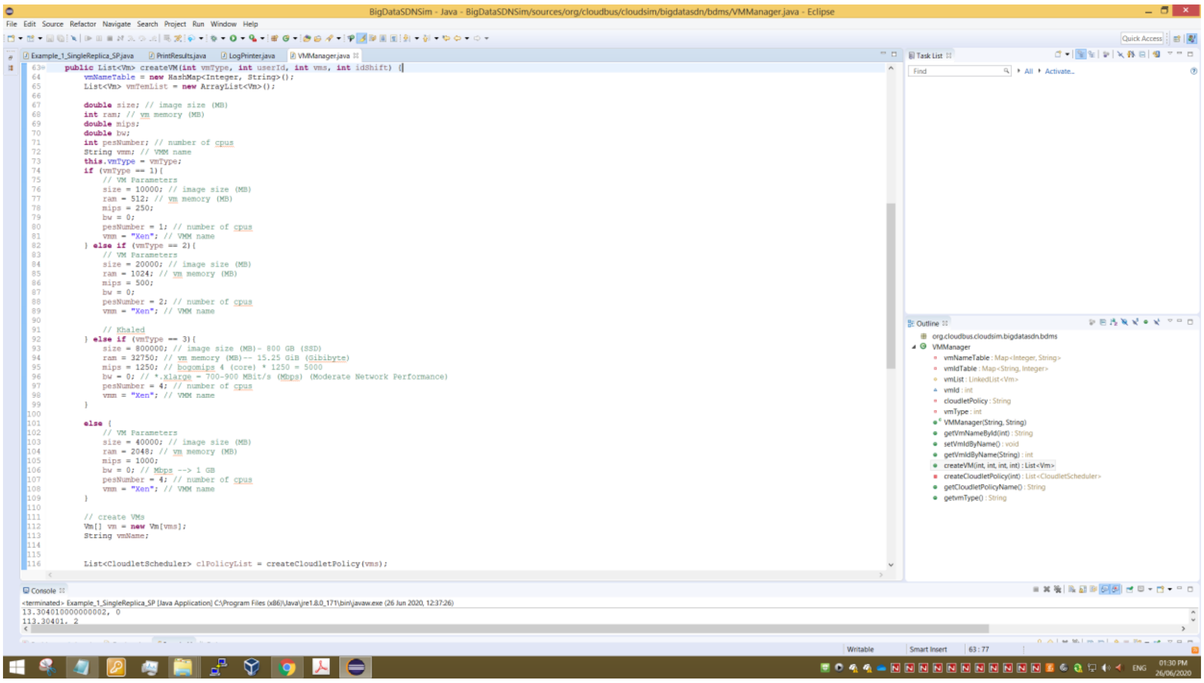


Figure 3.2

Table 3.2 The parameter description of VMs

Parameter	**Description**
size	The storage size of the VM
ram	Required memory ssize of the VM
mips	Million Instructions Per Second (MIPS) rate of the VM
bw	Bandwidth size of the VM

4 Simulation examples

Before starting the actual simulation, the processing and transmission logic of every MapReduce application must be provided. For the given examples, we have four different MapReduce logics, which is given in different CSV files. For every logic, we run two examples: one with a shortest path traditional network (SP) and the other with SDN load balancing. All the files contain similar parameters to be filled. The description of every parameter is given in Table 4.1. The file names of MapReduce logics are given as follows:

- SingleReplica_Workload (see Figure 4.1)
- ThreeReplica_Workload (see Figure 4.2)
- MultipleApps_ThreeReplica_Workload (see Figure 4.3)
- Priority_MultipleApps_ThreeReplica_Workload (see Figure 4.4)

Table 4.1 The parameter description of MapReduce applications

Parameter	**Description**
repliaction	The number of replication for every MapReduce application
appType	The application type, which is set to “MapReduce“
appID	The ID of every application
startTime	The start time of every application
CPU_Num	The required number of CPUs for every application
mapInput_GB	The data size given to every mapper in GB
Map_MI	The processing size in million instruction (MI) for every mapper
shuffleData_GB	The data input size for every reducer in GB
Reduce_MI	The processing size in million instruction (MI) for every reducer
reduceDataOutput_GB	The data output size for every reducer in GB
numberOfMappers	The number of required mappers
numberOfReducers	The number of required reducers
priority	Indicate if the MapReduce application is prioritized. The values of priority is defined as follows: 0 → no priority 1 → low priority 2 → medium priority 3 → high priority
hdfsBlockSize_MB	The data size of every MapReduce block in MB

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	repliaction	appType	appID	startTime	CPU_Num	mapInput_GB	Map_MI	shuffleData_GB	Reduce_MI	reduceDataOutput_GB	numberOfMappers	numberOfReducers	priority	hdfsBlockSize_MB
2	1	MapReduce	1	0	4	15	500000	0.75	150000	1	16	3	0	950

Figure 4.1 SingleReplica_Workload

1	repliaction	appType	appID	startTime	CPU_Num	mapInput_GB	Map_MI	shuffleData_GB	Reduce_MI	reduceDataOutput_GB	numberOfMappers	numberOfReducers	priority	hdfsBlockSize_MB
2	3	MapReduce	1	0	4	15	500000	0.75	150000	1	16	3	0	950

Figure 4.2 ThreeReplica_Workload

1	repliaction	appType	appID	startTime	CPU_Num	mapInput_GB	Map_MI	shuffleData_GB	Reduce_MI	reduceDataOutput_GB	numberOfMappers	numberOfReducers	priority	hdfsBlockSize_MB
2	3	MapReduce	1	0	4	15	500000	0.75	150000	1	16	3	0	950

Figure 4.3 MultipleApps_ThreeReplica_Workload

1	repliaction	appType	appID	startTime	CPU_Num	mapInput_GB	Map_MI	shuffleData_GB	Reduce_MI	reduceDataOutput_GB	numberOfMappers	numberOfReducers	priority	hdfsBlockSize_MB
2	3	MapReduce	1	0	4	15	500000	0.75	150000	1	16	3	1	950
3	3	MapReduce	2	0	4	15	500000	0.75	150000	1	16	3	1	950
4	3	MapReduce	3	0	4	15	500000	0.75	150000	1	16	3	2	950
5	3	MapReduce	4	0	4	15	500000	0.75	150000	1	16	3	2	950
6	3	MapReduce	5	0	4	15	500000	0.75	150000	1	16	3	3	950

Figure 4.4 Priority_MultipleApps_ThreeReplica_Workload

The list of examples is shown in Figure 4.5.

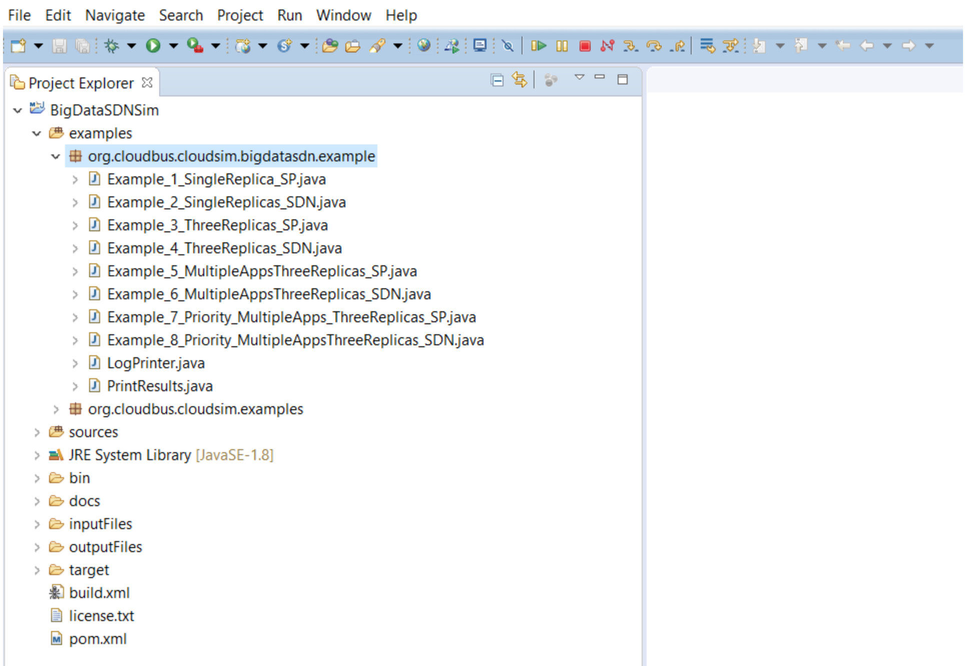


Figure 4.5

4.1 Policies

To run any example, you have to provide six policies. Figure 4.6 shows the list of policies already developed in BigDataSDNSim. The class of every example must contain the list of six policies. The following describes the purpose of every policy:

1. *VM placement:* It determines how to place VMs on a given host list.
2. *Application selection:* It is essential to be used to determine the selection criteria based on a given QoS (e.g. priority).
3. *HDFS replica placement:* It determines how to place HDFS replicas on elected VMs.
4. *VM-CPU scheduling:* It determines how to schedule MIPS of every VMs among mappers and reducers.
5. *Routing:* It is used to determine routes among VMs.
6. *Traffic:* It is used to control the sharing resources of a given network among MapReduce applications.

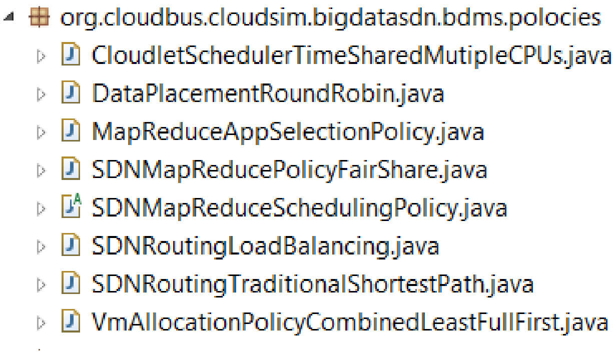


Figure 4.6

4.2 Output results of BigDataSDNSim

At the end of running every example, the output would be stored on result.txt located in the outputFiles folder. The results contains a lot of information. At the end of the result file, the results are structured as follows:

- SDN Network Results
- MapReduce Processing Outputs
- Mappers Outputs
- Reducers Outputs
- Forwarding Tables
- Host Power Consumption
- Switch Power Consumption
- Total Power Consumption

4.3 Running the first example (example 1)

Step 1: Select Example_1_SingleReplica_SP.java -> click on the small down arrow next to the play button and select Run Configurations (see Figure 4.7).

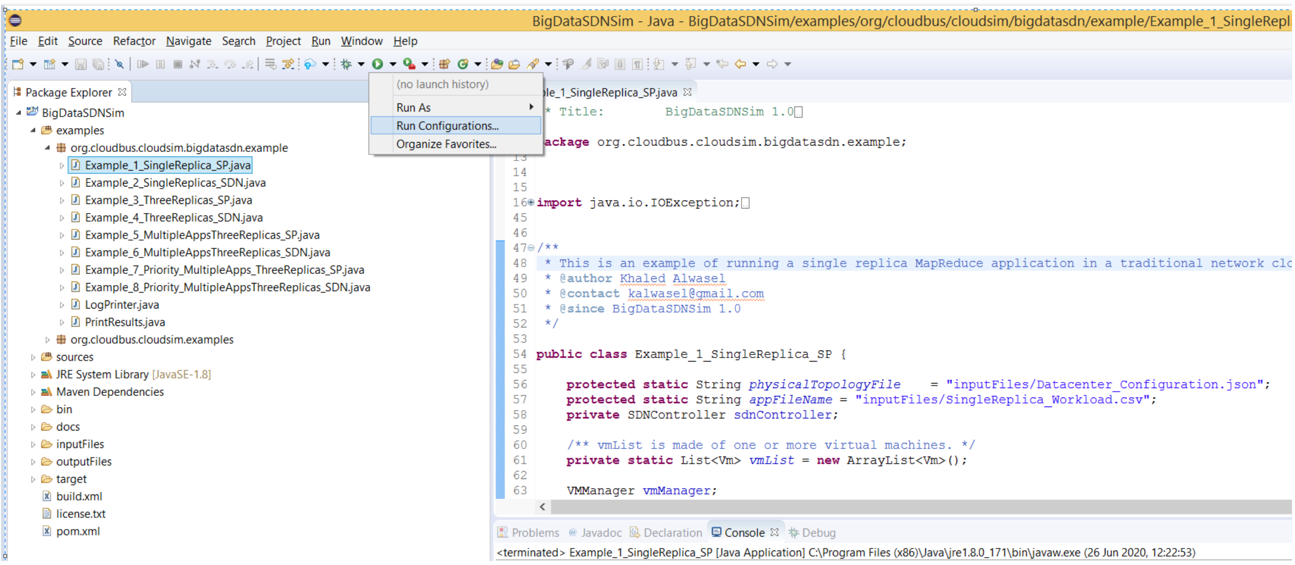


Figure 4.7

Step 2: Double click on Java Application and Eclipse will create the first example (see Figure 4.8).

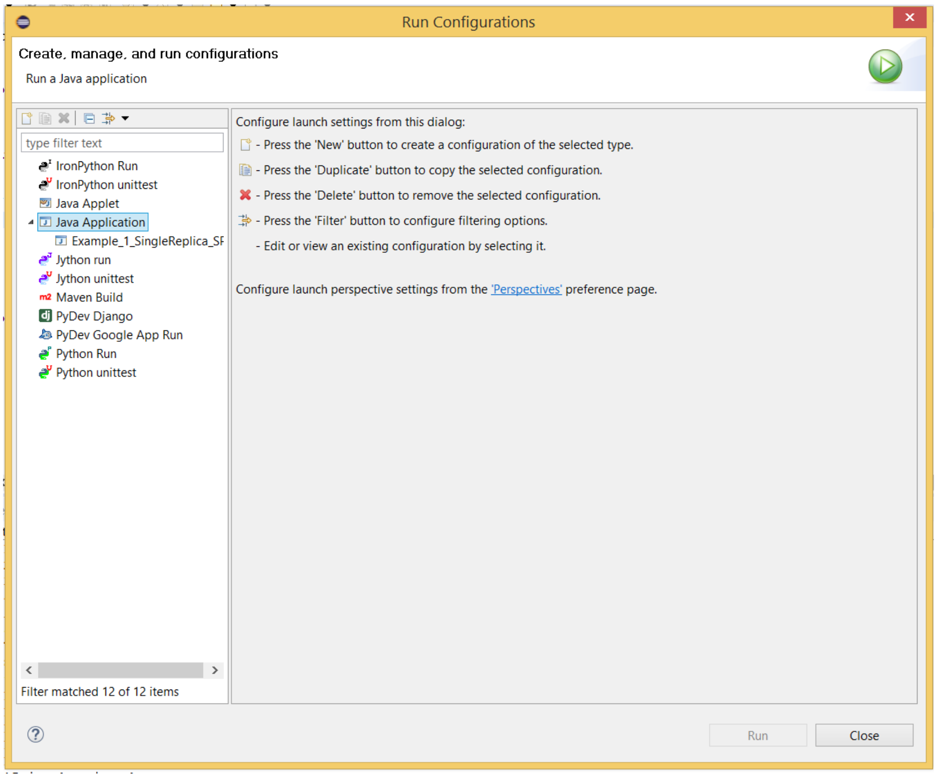


Figure 4.8

Step 2: Click on Common -> check mark Output File -> click workspace -> select BigDataSDNSim folder -> select outFiles folder -> select result.txt -> click Ok -> click Run (see Figure 4.9). This step will run the first example and store all the outputs on the result.txt file.

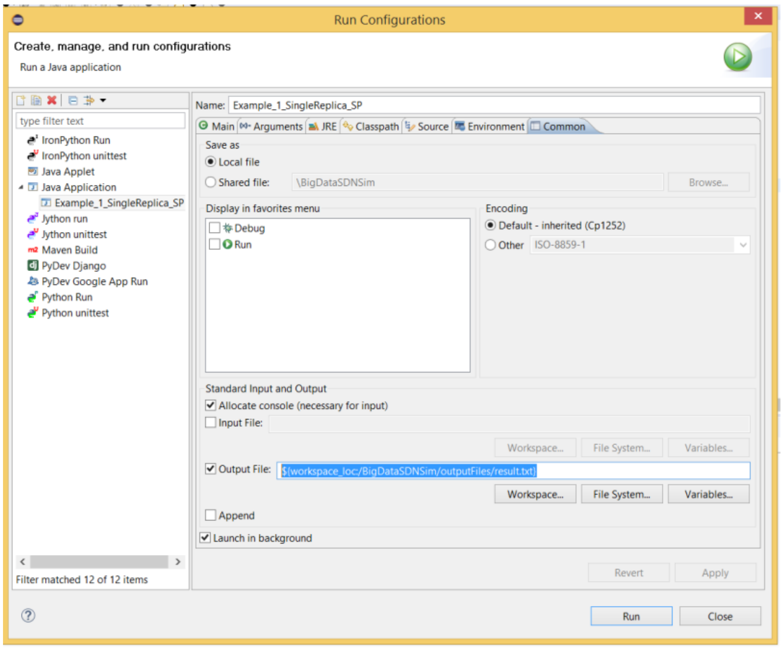
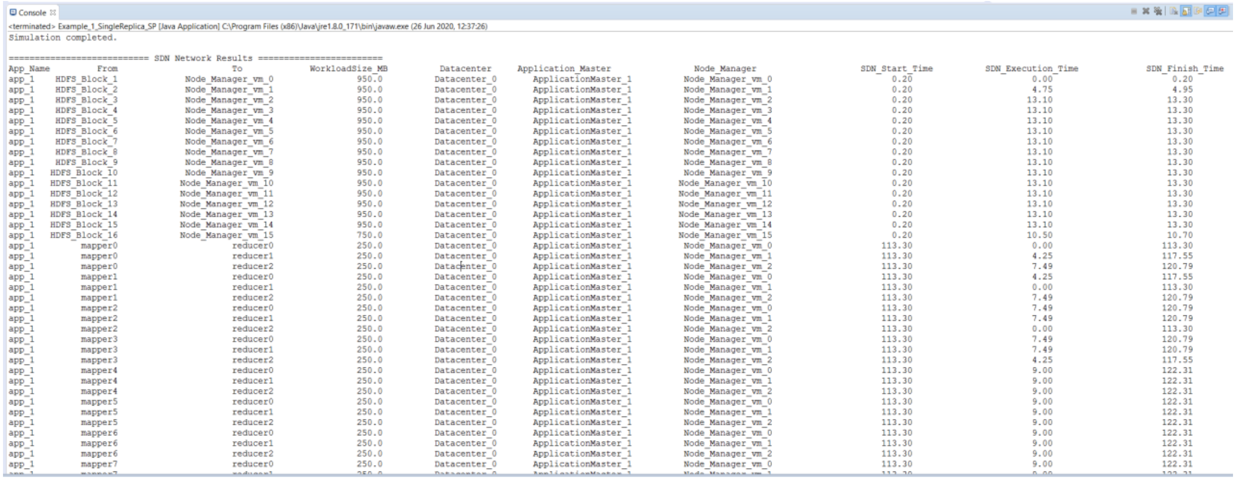


Figure 4.9

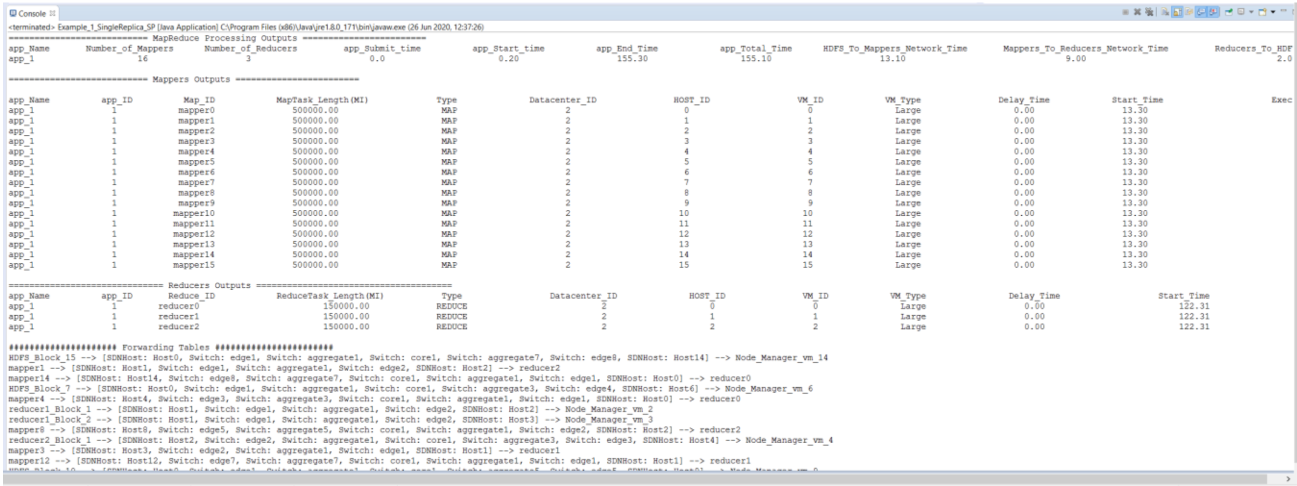
Figure 4.10 and Figure 4.11 show a sample of the result obtained by running the first example. The result is also stored in an excel file located in outputFiles folder. Similar steps given for the first example can be followed to execute the rest of the examples.



```
Console
<terminated> Example_1_SingleReplica_SP [Java Application] C:\Program Files (x86)\Java\jre1.8.0_171\bin\javaw.exe (26 Jun 2020, 12:37:26)
Simulation completed.

=========================== SDN Network Results ========================
App_Name  From          To                  WorkloadSize_MB  Datacenter    Application_Master    Node_Manager        SDN_Start_Time  SDN_Execution_Time  SDN_Finish_Time
app_1     HDFS_Block_1  Node_Manager_vm_0   950.0            Datacenter_0  ApplicationMaster_1   Node_Manager_vm_0   0.20            0.00                0.20
app_1     HDFS_Block_2  Node_Manager_vm_1   950.0            Datacenter_0  ApplicationMaster_1   Node_Manager_vm_1   0.20            4.75                4.95
app_1     HDFS_Block_3  Node_Manager_vm_2   950.0            Datacenter_0  ApplicationMaster_1   Node_Manager_vm_2   0.20            13.10               13.30
app_1     HDFS_Block_4  Node_Manager_vm_3   950.0            Datacenter_0  ApplicationMaster_1   Node_Manager_vm_3   0.20            13.10               13.30
app_1     HDFS_Block_5  Node_Manager_vm_4   950.0            Datacenter_0  ApplicationMaster_1   Node_Manager_vm_4   0.20            13.10               13.30
app_1     HDFS_Block_6  Node_Manager_vm_5   950.0            Datacenter_0  ApplicationMaster_1   Node_Manager_vm_5   0.20            13.10               13.30
app_1     HDFS_Block_7  Node_Manager_vm_6   950.0            Datacenter_0  ApplicationMaster_1   Node_Manager_vm_6   0.20            13.10               13.30
app_1     HDFS_Block_8  Node_Manager_vm_7   950.0            Datacenter_0  ApplicationMaster_1   Node_Manager_vm_7   0.20            13.10               13.30
app_1     HDFS_Block_9  Node_Manager_vm_8   950.0            Datacenter_0  ApplicationMaster_1   Node_Manager_vm_8   0.20            13.10               13.30
app_1     HDFS_Block_10 Node_Manager_vm_9   950.0            Datacenter_0  ApplicationMaster_1   Node_Manager_vm_9   0.20            13.10               13.30
app_1     HDFS_Block_11 Node_Manager_vm_10  950.0            Datacenter_0  ApplicationMaster_1   Node_Manager_vm_10  0.20            13.10               13.30
app_1     HDFS_Block_12 Node_Manager_vm_11  950.0            Datacenter_0  ApplicationMaster_1   Node_Manager_vm_11  0.20            13.10               13.30
app_1     HDFS_Block_13 Node_Manager_vm_12  950.0            Datacenter_0  ApplicationMaster_1   Node_Manager_vm_12  0.20            13.10               13.30
app_1     HDFS_Block_14 Node_Manager_vm_13  950.0            Datacenter_0  ApplicationMaster_1   Node_Manager_vm_13  0.20            13.10               13.30
app_1     HDFS_Block_15 Node_Manager_vm_14  950.0            Datacenter_0  ApplicationMaster_1   Node_Manager_vm_14  0.20            13.10               13.30
app_1     HDFS_Block_16 Node_Manager_vm_15  750.0            Datacenter_0  ApplicationMaster_1   Node_Manager_vm_15  0.20            10.50               10.70
app_1     mapper0       reducer0            250.0            Datacenter_0  ApplicationMaster_1   Node_Manager_vm_0   113.30          0.00                113.30
app_1     mapper0       reducer1            250.0            Datacenter_0  ApplicationMaster_1   Node_Manager_vm_1   113.30          4.25                117.55
app_1     mapper0       reducer2            250.0            Datacenter_0  ApplicationMaster_1   Node_Manager_vm_2   113.30          7.49                120.79
app_1     mapper1       reducer0            250.0            Datacenter_0  ApplicationMaster_1   Node_Manager_vm_0   113.30          4.25                117.55
app_1     mapper1       reducer1            250.0            Datacenter_0  ApplicationMaster_1   Node_Manager_vm_1   113.30          0.00                113.30
app_1     mapper1       reducer2            250.0            Datacenter_0  ApplicationMaster_1   Node_Manager_vm_2   113.30          7.49                120.79
app_1     mapper2       reducer0            250.0            Datacenter_0  ApplicationMaster_1   Node_Manager_vm_0   113.30          7.49                120.79
app_1     mapper2       reducer1            250.0            Datacenter_0  ApplicationMaster_1   Node_Manager_vm_1   113.30          7.49                120.79
app_1     mapper2       reducer2            250.0            Datacenter_0  ApplicationMaster_1   Node_Manager_vm_2   113.30          0.00                113.30
app_1     mapper3       reducer0            250.0            Datacenter_0  ApplicationMaster_1   Node_Manager_vm_0   113.30          7.49                120.79
app_1     mapper3       reducer1            250.0            Datacenter_0  ApplicationMaster_1   Node_Manager_vm_1   113.30          7.49                120.79
app_1     mapper3       reducer2            250.0            Datacenter_0  ApplicationMaster_1   Node_Manager_vm_2   113.30          4.25                117.55
app_1     mapper4       reducer0            250.0            Datacenter_0  ApplicationMaster_1   Node_Manager_vm_0   113.30          9.00                122.31
app_1     mapper4       reducer1            250.0            Datacenter_0  ApplicationMaster_1   Node_Manager_vm_1   113.30          9.00                122.31
app_1     mapper4       reducer2            250.0            Datacenter_0  ApplicationMaster_1   Node_Manager_vm_2   113.30          9.00                122.31
app_1     mapper5       reducer0            250.0            Datacenter_0  ApplicationMaster_1   Node_Manager_vm_0   113.30          9.00                122.31
app_1     mapper5       reducer1            250.0            Datacenter_0  ApplicationMaster_1   Node_Manager_vm_1   113.30          9.00                122.31
app_1     mapper5       reducer2            250.0            Datacenter_0  ApplicationMaster_1   Node_Manager_vm_2   113.30          9.00                122.31
app_1     mapper6       reducer0            250.0            Datacenter_0  ApplicationMaster_1   Node_Manager_vm_0   113.30          9.00                122.31
app_1     mapper6       reducer1            250.0            Datacenter_0  ApplicationMaster_1   Node_Manager_vm_1   113.30          9.00                122.31
app_1     mapper6       reducer2            250.0            Datacenter_0  ApplicationMaster_1   Node_Manager_vm_2   113.30          9.00                122.31
app_1     mapper7       reducer0            250.0            Datacenter_0  ApplicationMaster_1   Node_Manager_vm_0   113.30          9.00                122.31
```

Figure 4.10



```
Console
<terminated> Example_1_SingleReplica_SP [Java Application] C:\Program Files (x86)\Java\jre1.8.0_171\bin\javaw.exe (26 Jun 2020, 12:37:26)
=========================== MapReduce Processing Outputs ========================
app_Name  Number_of_Mappers  Number_of_Reducers  app_Submit_time  app_Start_time  app_End_Time  app_Total_Time  HDFS_To_Mappers_Network_Time  Mappers_To_Reducers_Network_Time  Reducers_To_HDF
app_1     16                 3                   0.0              0.20            155.30        155.10          13.10                         9.00                              2.0

=========================== Mappers Outputs ========================

app_Name  app_ID  Map_ID    MapTask_Length(MI)  Type  Datacenter_ID  HOST_ID  VM_ID  VM_Type  Delay_Time  Start_Time  Exec
app_1     1       mapper0   500000.00           MAP   2              0        0      Large    0.00        13.30
app_1     1       mapper1   500000.00           MAP   2              1        1      Large    0.00        13.30
app_1     1       mapper2   500000.00           MAP   2              2        2      Large    0.00        13.30
app_1     1       mapper3   500000.00           MAP   2              3        3      Large    0.00        13.30
app_1     1       mapper4   500000.00           MAP   2              4        4      Large    0.00        13.30
app_1     1       mapper5   500000.00           MAP   2              5        5      Large    0.00        13.30
app_1     1       mapper6   500000.00           MAP   2              6        6      Large    0.00        13.30
app_1     1       mapper7   500000.00           MAP   2              7        7      Large    0.00        13.30
app_1     1       mapper8   500000.00           MAP   2              8        8      Large    0.00        13.30
app_1     1       mapper9   500000.00           MAP   2              9        9      Large    0.00        13.30
app_1     1       mapper10  500000.00           MAP   2              10       10     Large    0.00        13.30
app_1     1       mapper11  500000.00           MAP   2              11       11     Large    0.00        13.30
app_1     1       mapper12  500000.00           MAP   2              12       12     Large    0.00        13.30
app_1     1       mapper13  500000.00           MAP   2              13       13     Large    0.00        13.30
app_1     1       mapper14  500000.00           MAP   2              14       14     Large    0.00        13.30
app_1     1       mapper15  500000.00           MAP   2              15       15     Large    0.00        13.30

============================== Reducers Outputs ====================================
app_Name  app_ID  Reduce_ID  ReduceTask_Length(MI)  Type    Datacenter_ID  HOST_ID  VM_ID  VM_Type  Delay_Time  Start_Time
app_1     1       reducer0   150000.00              REDUCE  2              0        0      Large    0.00        122.31
app_1     1       reducer1   150000.00              REDUCE  2              1        1      Large    0.00        122.31
app_1     1       reducer2   150000.00              REDUCE  2              2        2      Large    0.00        122.31

##################### Forwarding Tables #######################
HDFS_Block_15 --> [SDNHost: Host0, Switch: edge1, Switch: aggregate1, Switch: core1, Switch: aggregate7, Switch: edge8, SDNHost: Host14] --> Node_Manager_vm_14
mapper1 --> [SDNHost: Host1, Switch: edge1, Switch: aggregate1, Switch: edge2, SDNHost: Host2] --> reducer2
mapper14 --> [SDNHost: Host14, Switch: edge8, Switch: aggregate7, Switch: core1, Switch: aggregate1, Switch: edge1, SDNHost: Host0] --> reducer0
HDFS_Block_7 --> [SDNHost: Host0, Switch: edge1, Switch: aggregate1, Switch: core1, Switch: aggregate3, Switch: edge4, SDNHost: Host6] --> Node_Manager_vm_6
mapper4 --> [SDNHost: Host4, Switch: edge3, Switch: aggregate3, Switch: core1, Switch: aggregate1, Switch: edge1, SDNHost: Host0] --> reducer0
reducer1_Block_1 --> [SDNHost: Host1, Switch: edge1, Switch: aggregate1, Switch: edge2, SDNHost: Host2] --> Node_Manager_vm_2
reducer1_Block_2 --> [SDNHost: Host1, Switch: edge1, Switch: aggregate1, Switch: edge2, SDNHost: Host3] --> Node_Manager_vm_3
mapper8 --> [SDNHost: Host8, Switch: edge5, Switch: aggregate5, Switch: core1, Switch: aggregate1, Switch: edge2, SDNHost: Host2] --> reducer2
reducer2_Block_1 --> [SDNHost: Host2, Switch: edge2, Switch: aggregate1, Switch: core1, Switch: aggregate3, Switch: edge3, SDNHost: Host4] --> Node_Manager_vm_4
mapper3 --> [SDNHost: Host3, Switch: edge2, Switch: aggregate1, Switch: edge1, SDNHost: Host1] --> reducer1
mapper12 --> [SDNHost: Host12, Switch: edge7, Switch: aggregate7, Switch: core1, Switch: aggregate1, Switch: edge1, SDNHost: Host1] --> reducer1
```

Figure 4.11

5 Contact

Please feel free to contact me if you need any further information at kalwasel@gmail.com
This manual is written by Khaled Alwasel